PEMR 8304

Sixth Semester Examination – 2008

MECHANICS OF MACHINES – II

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1.　Answer the following questions :　　2 ×10

　(a)　Differentiate giving examples :
　　　(i)　Lower and higher pairs
　　　(ii)　Closed and unclosed pairs
　　　(iii)　Turning and rolling pairs.

　(b)　What is Kutzback's criterion for degree of freedom of plane mechanisms ? In what way 'Gruebler's criterion is different from it ?

　(c)　Why parallel-crank four-bar linkage and deltoid linkage are considered special cases of four-link mechanisms ?

　(d)　Describe briefly the procedure to construct a velocity diagram of a four-link mechanism.

　(e)　Compare the performance of knife edge, roller and mushroom followers of a cam mechanism.

　(f)　Why is balancing necessary for rotors of high speed engines ?

　(g)　Make a comparison of cycloidal and involute gear tooth forms.

　(h)　Discuss the gyroscopic effect on sea vessels.

　(i)　What do you mean by whirling of shafts ? What is whirling or critical speed ?

　(j)　Discuss the difference between 'Bifilar' and 'Trifilar' suspension.

2. In a vertical double acting steam engine, the connecting rod is 4.5 times the crank. Weight of the reciprocating parts is 125 kg and the stroke of the piston is 444 mm. The engine runs at 256 rpm. If the net load on the piston due to steam pressure is 26 kN when the crank has turned through an angle of 120° from the top dead centre, determine :   10

(a) The thrust in the connecting rod

(b) The pressure on slide bars

(c) The tangential force on the crank pin

(d) The thrust on the bearings

(e) The turning moment on the crank shaft.

3. The turning moment diagram for a petrol engine is drawn to a vertical scale of 1 mm = 500 Nm and a horizontal scale of 1 mm = 3°. The turning moment diagram repeats itself every half revolution of the crank shaft. The areas above and below the mean torque line are 260, −580, 80, −380, 870 and −250 mm². The rotating parts have a mass of 55 kg and radius of gyration of 2.1 m. If the engine speed is 1600 rpm, determine the co-efficient of fluctuation of speed.   10

4. A cam with a minimum radius of 25 mm is to be designed for a knife edge follower with the following data :

(a) to raise the follower through 35 mm during 60° rotation of the cam

(b) dwell for next 40° of the cam rotation

(c) descending of the follower during the next 90° of the cam rotation

(d) dwell during the rest of the cam rotation.

Draw the profile of the cam if the ascending and descending of the cam is with simple harmonic motion and the line of stroke of the follower is offset 10 mm from the axis of the cam shaft. What is the maximum velocity and acceleration of the follower during the ascent and the descent if the cam rotates at 150 rpm ? 10

5. A rotating shaft carries three unbalanced masses 4 kg, 3 kg and 2.5 kg at radial distances 75 mm, 85 mm and 50 mm and at the angular positions of 45°, 135° and 240° respectively. The second and third masses are in the planes at 200 mm and 375 mm from the plane of the first mass. The angular positions are measured counter-clockwise from the reference line along x-axis and viewing the shaft from first mass end.

Determine the amount of the counter masses in planes at 75 mm from the bearings for the complete balance of the shaft. The first counter mass is to be in a plane between the first mass and the bearing and the second mass in a plane between the third mass and the bearing at that end. 10

6. Two 20° involute spur gears have a module of 10 mm. The addendum is one module. The larger gear has 50 teeth and the pinion 13 teeth. Does the interference occur ? If it occurs, what value should the pressure angle be changed to eliminate interference ? 10

7. A disc with radius of gyration 60 mm and a mass of 4 kg is mounted centrally on a horizontal axes of 80 mm length between the bearings. It spins about the axle at 800 rpm counter-clockwise when viewed from the right-

hand side bearing. The axle precesses about a vertical axis at 50 rpm in the clockwise direction when viewed from above. Determine the resultant reaction at each bearing due to the mass and the gyroscopic effect.   10

8.   A vibrating system consists of a mass of 50 kg, a spring of stiffness 30 kN/m and a damper. The damping provided is only 20% of the critical value. Determine :   10

(a)   the damping factor

(b)   the critical damping co-efficient

(c)   the natural frequency of damped vibra-tion

(d)   the logarithmic decrement

(e)   the ratio of two consecutive amplitudes.

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